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NATIONAL MARINE FISHERIES SERVICE
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PRELIMINARY CRUISE RESULTS NOAA SHIP MILLER FREEMAN CRUISE NO. 93-01 ECHO INTEGRATION-MIDWATER TRAWL SURVEY OF POLLOCK IN THE BERING SEA

CRUISE PERIOD, AREA, AND SCHEDULE

Scientists from the Alaska Fisheries Science Center (AFSC) conducted an echo integration-midwater trawl (EIMWT) survey of walleye pollock (Theragra chalcogramma) aboard the NOAA ship Miller Freeman from January 15 to March 12, 1993. The cruise began in Seattle, Washington, and ended in Dutch Harbor, Alaska. The areas of operations included basin waters near Bogoslof Island, the western Bering Sea shelf and slope, and the southeast Bering Sea shelf and slope. This cruise was part of a cooperative survey effort involving the United States, Japan, and Russia. In addition to the Miller Freeman, the Japan Fisheries Agency's research vessel Kaiyo maru conducted an EIMWT survey of the eastern and western Aleutian basin. Researchers from Russia, China, Poland, and South Korea participated as guest scientists aboard the two vessels.

The Miller Freeman's itinerary was as follows:

Jan 15-16	Trawl gear tests and sphere calibration in Puget Sound
Jan 16-21	Transit to Kodiak
Jan 22	Inport Kodiak; offload scientific equipment
Jan 23-26	Transit to Dutch Harbor; sphere calibration in Beaver Inlet (Ugadaga Bay)
Jan 26-Feb 1	Layover in Dutch Harbor due to generator failure
Feb 1-4	Intership calibration with Kaiyo maru
Feb 5	Sphere calibration in Makushin Bay

Feb 5-9	EIMWT survey of Bogoslof Island region with no trawling (Pass 1)
Feb 10	EIMWT survey of Seguam Pass area
Feb 10-11	Transit to Adak Island
Feb 12-13	Depart Adak after generator repair; transit to western Bering Sea
Feb 14-23	EIMWT survey of western Bering Sea shelf and slope
Feb 23-26	Transit to Dutch Harbor
Feb 26-27	Inport Dutch Harbor; exchange scientists
Feb 27-Mar 5	EIMWT survey of Bogoslof Island region with trawling (Pass 2)
Mar 6	Transit to eastern Bering Sea shelf and slope
Mar 6-12	EIMWT survey of eastern Bering Sea shelf and slope
Mar 12	Transit to Dutch Harbor; end of survey

OBJECTIVES

The principal objectives of the cruise were to:

1. collect echo-integration data and midwater and demersal trawl data necessary to determine the distribution, biomass, and biological composition of walleye pollock in the areas of operations;
2. collect pollock target strength data for scaling echo-integration data to estimates of absolute abundance;
3. calibrate the acoustic system using standard sphere techniques;
4. conduct an intership calibration of the acoustic systems aboard the U.S. research vessel Miller Freeman and the Japanese research vessel Kaiyo maru;
5. collect pollock ovary and liver tissue samples for stock structure studies;
6. collect and preserve whole pollock stomachs for food habits studies;

7. spawn mature pollock from the Bogoslof Island area and culture fertilized pollock eggs for laboratory experiments on larval pollock growth rate and metabolism;

8. collect temperature and salinity profile data in areas of pollock abundance;

9. deploy satellite drifters in potential pollock spawning locations to track surface current patterns;

10. collect samples of cephalopods for a marine mammal prey study;

11. collect capelin (Mallotus villosus), smelt (Osmeridae), eulachon (Thaleichthys pacificus), sandfish (Trichodon trichodon), and other principal forage fishes of marine mammals and birds in the Aleutian Islands and Bering Sea to obtain caloric and fat content information; and

12. observe and record data on marine mammals sighted during the survey.

VESSEL, ACOUSTIC EQUIPMENT, AND TRAWL GEAR

The survey was conducted on board the NOAA ship Miller Freeman, a 66-m (216-ft) stern trawler equipped for fisheries and oceanographic research. Acoustic data were collected with a quantitative echo-sounding system (Simrad EK500[1]). A Simrad 38-kHz split-beam transducer was mounted on the distal end of the vessel's centerboard. With the centerboard fully extended, the transducer was 9 m below the water surface. System electronics were housed in a portable laboratory mounted on the vessel's weather deck. Data from the Simrad EK500 echo-sounder/receiver were processed using Simrad BI500 echo-integration and target strength data analysis software on a SUN workstation.

Midwater echo sign was sampled using a modified Northern Gold 1200 midwater rope trawl (NET Systems, Inc.). The trawl was constructed with ropes in the forward section and stretch mesh sizes ranging from 163 cm (64 in) immediately behind the rope section to 8.9 cm (3.5 in) in the codend. It was fished in a bridleless configuration and was fitted with a 3.2-cm (1.25-in) mesh codend liner. Headrope and footrope lengths were 94.5 m (310 ft) and 50 m (164 ft), respectively, and the breastlines measured 79.4 m (260.5 ft). The headrope length was measured between the points of attachment to the breastline. The footrope length was measured between the points where the tom weights are

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[1] Reference to trade names or commercial firms does not constitute U.S. Government endorsement.

attached. The net was fished with 1.8-m X 2.7-m (6-ft X 9-ft) steel V-doors [1,000 kg (2,200 lb)] and 340-kg (750-lb) tom weights on each side. Trawl mouth opening and depth were monitored with a Furuno wireless netsounder system attached to the headrope of the trawl.

Four additional trawls were used to sample fish under different circumstances. In the western Bering Sea, fish on and near bottom were sampled with an 83/112 bottom trawl with roller gear. Net mesh sizes ranged from 10.2 cm (4 in) forward and 8.9 cm (3.5 in) in the codend to 3.2 cm (1.25 in) in the codend liner. Headrope and footrope lengths were 25.6 m and 34.1 m (83.9 ft and 111.9 ft), respectively, and the breastlines measured 3.4 m and 3.2 m (11.3 ft and 10.5 ft). An 83/112 without roller gear was used on the eastern Bering Sea shelf. Smaller organisms and juvenile fish in midwater were sampled with a Marinovich midwater trawl, with meshes measuring 7.6 cm (3.0 in) forward, 3.2 cm in the codend, and 0.32 cm (1/8 in) in the codend liner. Headrope and footrope lengths were each 9.1 m (30 ft). The Marinovich and 83/112 demersal trawls were fished with the same steel V-doors used with the rope trawl. Trawl mouth opening and depth were monitored with the Furuno netsounder system. Ichthyoplankton and zooplankton were sampled with a 60-cm (23.6-in) Bongo net with 333 micron mesh.

Water temperature/salinity profile data were collected at trawl and calibration sites using a Seabird CTD (conductivity/ temperature/depth) system. Expendable bathythermographs (XBT) were launched routinely during the survey period to provide additional temperature profile data. In the western Bering Sea, a systematic XBT sampling grid was employed, with emphasis on obtaining profiles from shelf and slope stations near the ice edge.

In order to track prevailing shelf/slope current patterns, three sets of satellite drifters were deployed from the stern of the vessel at western Bering Sea locations in Olyutorsky Bay (59° 57′ N, 167° 58′ E) and northeast of Cape Olyutorsky (60° 40′ N, 172° 41′ E) and on the eastern Bering Sea shelf near the Pribilof Islands (56° N 168° 03′ W). The drifters were released in groups of three, each group forming an equilateral triangle with 5-km sides. Release locations were chosen to coincide with pollock spawning areas.

SURVEY METHODS

The 1993 winter EIMWT survey began in Puget Sound, Washington. After completion of the gear trials and sphere calibration, the Miller Freeman transited to Kodiak, Alaska, to offload equipment and then on to Dutch Harbor to embark scientists. Mechanical problems aboard the Miller Freeman delayed the start of the

survey, causing modification of the original cruise plan and preventing coverage of the entire eastern and western Bering Sea shelf and slope regions.

From February 1-10, the survey was conducted with the acoustic data collection system operating but with no fishing capability. Scientists aboard the Miller Freeman conducted an intership calibration with the Kaiyo maru and a sphere calibration in Makushin Bay and completed a single acoustic data collection pass through the Bogoslof Island area. This first Bogoslof survey was conducted westward from 166° to about 170° W longitude along parallel, north-south transects spaced 10 nmi apart. As the vessel transited westward to Adak Island for repairs, scientists conducted a brief acoustic survey to assess the presence of marine mammal forage fishes in the Seguam Pass area.

With full EIMWT operations restored on February 12, the vessel left Adak for the western Bering Sea. On February 14, scientists began surveying pollock in the nearshore shelf and slope region from the Gulf of Ozernoi to about 61° N (Fig. 1). Transects were oriented northwest-southeast and spaced 20 nmi apart west of Cape Olyutorsky and 30 nmi apart east of the Cape. Sea ice floes just inside Olyutorsky Bay prevented the vessel from proceeding farther north and west. Although the vessel did not encounter ice east of Cape Olyutorsky, its progress was slowed considerably during the last three days by a storm, preventing it from reaching the Cape Navarin area. After leaving the western Bering Sea, the ship transited to Dutch Harbor, exchanged scientists, and proceeded to the Bogoslof area for a second pass (Fig. 2) over the pollock spawning aggregations. Finally, scientists aboard the Miller Freeman surveyed the southeastern Bering Sea shelf and slope pollock populations from St. Paul Island (57° N, 173° W) to the Aleutian chain. The parallel transects were oriented southwest-northeast at 30 nmi spacing (Fig. 2).

Survey operations were conducted both day and night. While transecting, vessel speed averaged about 11 knots, with the speed varying between 3 and 12 knots, depending upon weather conditions. The acoustic system collected echo-integration data and split-beam target strength data. Target strength data will be interpreted together with historical target strength information and then used to scale echo-integration values to provide estimates of pollock density (kg/m^2).

Midwater and demersal trawl hauls were made at selected locations (Figs. 1 and 2) to identify echo sign and provide biological samples. The average trawling speed was about 3 knots. The vertical net opening for the midwater rope trawl averaged about 21 m and ranged between 16 m and 26 m. The net opening for the Marinovich midwater trawl was 3-4 m. The 83/112 mouth opening

was about 6-7 m. Standard catch sorting and biological sampling procedures were used to provide weight and number by species for each haul. Pollock were further sampled to determine sex, length, body weight, age, maturity, gonad weight, and stomach contents. In certain areas, tissue samples were collected and frozen for stock structure studies.

The National Marine Mammal Laboratory (NMML) placed marine mammal observers on board the Miller Freeman. When environmental conditions allowed, the observers conducted marine mammal sighting effort from the flying bridge.

PRELIMINARY RESULTS

Standard Sphere Calibrations

Standard sphere calibrations were conducted in Port Susan on January 16; in Beaver Inlet, Unalaska Island, on January 26; and in Makushin Bay, Unalaska Island, on February 5. An additional calibration was conducted on March 19 in Malina Bay, Kodiak Island, during an EIMWT survey of Shelikof Strait. Acoustic properties of a copper sphere suspended below the transducer were measured. The standard sphere (60.0 mm diameter) had a known target strength of -33.6 dB. Split-beam target strength and echo-integration data were collected with the Simrad EK500 system during all calibrations, except in Beaver Inlet when bad weather prevented collection of integration data. On February 5, a tungsten carbide sphere 38.1 mm diameter (with a known target strength of -42.3 dB) was included in the calibration. The data collected describe transducer beam pattern characteristics and other acoustic system parameters. No significant differences in the acoustic system parameters were observed among any of the four calibrations.

Intership Calibration

From February 1-4, the Miller Freeman and the Japanese vessel Kaiyo maru conducted an intership calibration of their acoustic data collection systems in order to be able to compare cruise results from this cooperative EIMWT survey. After location of suitable fish echo sign about 7 nmi southwest of Bogoslof Island, the two vessels ran a series of 24 transects (each approximately 9-12 nmi in length) with one vessel leading the other, the two vessels separated by 0.5 nmi. After completing each pair of transects, the vessels switched leader-follower positions to reduce potential biases affecting acoustic data collection due to vessel noise, wave direction, or weather. When data from the first 11 transects were compared, similar trends in fish density emerged, but the average ratio of Japanese to U.S. SA (scattering area, estimate of relative fish density) was approximately 2:1. During the rest of the intercalibration transect series, we

conducted tests to determine the source of the 2:1 difference. Our initial attempts to explain the difference were unsuccessful. Solving the problem will require further data analyses and discussion between scientists from the two nations.

Biological, Oceanographic, and Target Strength Data Collection

Biological data were collected and specimen and tissue samples preserved for all survey areas. Trawl station and catch data from 38 midwater (37 rope and 1 Marinovich) and 5 demersal trawl hauls are summarized in Table 1. Pollock was the dominant fish species captured in midwater trawl hauls in all areas (Tables 2, 4, and 5), except for a single haul (haul 10) in the western Bering Sea where Pacific herring (Clupea pallasi) dominated the catch. In the two demersal trawl catches on the western Bering Sea shelf east of Cape Olyutorsky, pollock accounted for a little over half the catch in numbers and rock sole (Pleuronectes bilineatus) about one quarter (Table 3). On the eastern Bering Sea shelf, pollock dominated two of three demersal trawl catches and yellowfin sole (Pleuronectes asper) made up nearly 90% by weight of the third (Table 6). Biological data collected for pollock are tallied in Table 7.

Oceanographic data comprised 29 CTD casts (Table 8) and 90 XBT casts (Table 9, Figs. 3 and 4). The satellite drifters released in the western and eastern Bering Sea continue to be monitored, providing valuable data on currents that potentially influence pollock egg and larval distribution. Marine mammal observers recorded a total of 94 sightings during the entire survey, 80 of which were Dalls porpoise (Phoconoides dalli). Four other species were sighted: killer whale (Orcinus orcina), sperm whale (Physter macrocephalus), minke whale (Balaenoptera acutorostrata), and Steller sea lion (Eumetopias jubatus).

Target strength data were collected on one aggregation of pollock on the western Bering Sea shelf. This involved transecting slowly (3 kts) over the aggregation to collect target strength data for 4-5 hours and comparing the acoustic information to biological data from hauls 3 and 4, conducted just prior to and just after acoustic data collection, respectively.

Western Bering Sea

In the western Bering Sea, most pollock were encountered west of Cape Olyutorsky, although pollock were found throughout the survey area (Fig. 1). Pollock aggregations usually extended from just inshore of the shelf-slope break to a few miles offshore, and then diminished over deep water (Fig. 5a). Most of the pollock captured on the shelf west of Cape Olyutorsky were < 40 cm in length (Fig. 6a, b). Farther offshore, larger fish were captured along with the juveniles (Fig. 6c). East of Cape Olyutorsky, pollock echo sign was less dense and more patchy in

distribution than west of the Cape (Fig. 5b). Two bottom trawls in this area caught pollock that spanned a wide size range (Fig. 6d). About 50 percent of western Bering Sea adult females sampled were in a developing (immature) stage; the other half were in a prespawning (mature reproductive) stage. Maturity was related to length; larger fish were more likely to be prespawning than smaller fish, but developing females were found throughout the length range (Fig. 7a). Gonadosomatic indexes (GSIs) for prespawning females were low relative to those observed from other areas (Fig. 7b).

Bogoslof Island

Two passes were made through the southeastern Aleutian Basin near Bogoslof Island, the first February 5-9 and the second February 27-March 5. During the first pass, dense concentrations of pollock echo sign were observed 400-500 m from the surface. Pollock were distributed mainly along the southern third of each transect, within approximately 30 nmi of the Aleutian chain (Fig. 8a). On the second pass through the area, similar dense pollock concentrations were encountered at similar depths, although in some cases layers were located higher in the water column and spanned a 200-m depth range. Pollock echo sign was again mainly on the southern ends of the transects; the western-most transects were relatively blank (Fig. 8b). Contrasting echo-sign distribution between passes 1 and 2 suggests that during pass 1 pollock may have been arriving at the spawning grounds from the west. Preliminary analyses of the acoustic data indicate that abundance has not changed significantly since the 1992 survey.

Pollock caught in hauls 19-25 and 43 had lengths between 38-64 cm with a length mode at 53 cm (Fig. 9). Echo sign was distributed in layers between 300-500 m over relatively deep water (> 800 m). In early March, females were largely in a prespawning reproductive stage (hauls 19-25, Fig. 10a) and average GSI was 0.22 (Fig. 10b). A bongo tow made southwest of Bogoslof Island on March 4 caught pollock eggs, confirming that some spawning had taken place. On March 12, spawning pollock were captured in a single haul (haul 43) made north of Bogoslof Island. Information from scientists aboard the Japanese vessel Kaiyo maru indicated that by mid-March many pollock had already spawned.

Proportions of fish at length for three other hauls (14, 16, and 18) made in early March over shallower bottom depths (< 600 m) east and south of the main spawning population were different. They ranged from 24 to 64 cm with a length mode at 40 cm (Fig. 9). Over 80% of these females were developing rather than prespawning. Echo sign for hauls 14 and 18 appeared at shallower depths close to the shelf and had a wave-like signature in contrast to hauls 19-25. Pollock echo sign sampled by haul 16

was less dense but otherwise looked similar to sign encountered elsewhere in the Bogoslof area.

Eastern Bering Sea

In surveying the southeastern Bering Sea shelf, scientists aboard the Miller Freeman encountered pollock echo sign from the middle of the first transect off St. Paul Island through the last transect north of Unimak Island. Bottom depths were usually less than 200 m. The echo sign was less uniformly layered than Bogoslof echo sign and was vertically and horizontally patchy. On the shelf near the Pribilof Islands, a wide range of pollock lengths was observed (Fig. 11a, b). In the deeper waters of Pribilof Canyon, only large fish were captured (Fig. 11c). In shelf waters (100-150 m bottom depth) between Pribilof Canyon and the Aleutian chain, eight of nine hauls with a significant pollock catch captured fish between 30-45 cm (Fig. 11d). The exception (haul 40), from shallow (80-m) waters near Amak Island, caught pollock ranging in length from 36-75 cm. About half of the female pollock between 30-45 cm in length were prespawning; the other half were developing. Females greater than 45 cm were generally prespawning (Fig. 12a). Very little active spawning was observed on the eastern Bering Sea shelf. Female GSIs were lower on average than those for Bogoslof, even though they were sampled later in March, suggesting a later spawning time for the shelf (Fig. 12b). To some extent lower GSI may also reflect the length ranges encountered in each area, as GSI at any given time is thought to be positively correlated with length.

SCIENTIFIC PERSONNEL

Name	Sex/ Nationality	Position	Organization
Puget Sound--January 15-16, 1993			
Neal Williamson	M/USA	Chief Scientist	AFSC
Dan Twohig	M/USA	Electronics Tech.	AFSC
Stephen de Blois	M/USA	Fish. Biologist	AFSC (Jan 15)
Terry Tinker	M/USA	Electronics Tech.	AFSC
Chris Wilson	M/USA	Fish. Biologist	AFSC (Jan 15)
Dave Kachel	M/USA	Oceanographer	PMEL
Marie Schall	F/USA	Oceanographer	PMEL (Jan 15)
Ned Cokelet	M/USA	Oceanographer	PMEL (Jan 15)
Dan Dougherty	M/USA	Oceanographer	PMEL (Jan 15)

Transit--January 16-25, 1993)

Dan Twohig	M/USA	Electronics Tech.	AFSC
Stephen de Blois	M/USA	Fish. Biologist	AFSC (Jan 21-5)

January 26-February 26, 1993

Neal Williamson	M/USA	Chief Scientist	AFSC
Dan Twohig	M/USA	Electronics Tech.	AFSC
Taina Honkalehto	F/USA	Fish. Biologist	AFSC
Denise McKelvey	F/USA	Fish. Biologist	AFSC
Terry Tinker	M/USA	Electronics Tech.	AFSC
Stephen de Blois	M/USA	Fish. Biologist	AFSC
Charles Hutchinson	M/USA	Wildlife Biologist	NMML
Mikhail Stepanenko	M/Russia	Fish. Biologist	TINRO
Vladimir Vologdin	M/Russia	Acoustician	TINRO
Xiangyong Zhao	M/China	Acoustician	YSFRI

February 27-March 12, 1993

Neal Williamson	M/USA	Chief Scientist	AFSC
Dan Twohig	M/USA	Electronics Tech.	AFSC
Chris Wilson	M/USA	Fish. Biologist	AFSC
Dennis Benjamin	M/USA	Fish. Biologist	AFSC
Stephen de Blois	M/USA	Fish. Biologist	AFSC
Mandy Merklein	F/USA	Fish. Biologist	NMML
Lowell Fair	M/USA	Graduate Student	UAK
Mikhail Stepanenko	M/Russia	Fish. Biologist	TINRO
Vladimir Vologdin	M/Russia	Acoustician	TINRO
Xiangyong Zhao	M/China	Acoustician	YSFRI

AFSC - Alaska Fisheries Science Center, Seattle, Washington
PMEL - Pacific Marine Environmental Laboratory, Seattle, Washington
NMML - National Marine Mammal Laboratory, Seattle, Washington
UAK - University of Alaska, Juneau, Alaska
TINRO - Pacific Research Institute of Fisheries and Oceanography, Vladivostok, Russia
YSFRI - Yellow Sea Fisheries Research Institute, Qingdao, China

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Table 1. Summary of trawl stations and catch data from the winter 1993 EIMWT survey of the Bering Sea, Miller Freeman cruise 93-1.

HAUL NO.	AREA	DATE (1993)	TIME (AST)	START POSITION LAT.	START POSITION LONG.	TEMP (C) GEAR	TEMP (C) SURF	DEPTH (M) GEAR	DEPTH (M) BOTM	CATCH (LBS/NOS.) POLLOCK	CATCH (LBS/NOS.) OTHER
1	1	12 FEB	1727-1822	52 1.6 N	176 33.1 W	---	3.5	---	1072	62/29	359/269
2	1	15 FEB	1457-1541	57 8.4 N	163 25.0 E	-0.2	-1.4	478	709	282/251	10/254
3	1	16 FEB	0100-0130	57 49.4 N	163 37.7 E	-0.8	-1.4	104	130	384/2787	4/5
4	1	16 FEB	0749-0820	57 50.0 N	163 39.0 E	-1.0	-1.4	117	124	142/1521	9/1
5	1	16 FEB	1330-1340	58 1.9 N	163 44.9 E	1.2	-1.3	307	414	1524/1804	56/10
6	1	17 FEB	0357-0437	58 36.7 N	164 27.1 E	3.4	-0.0	548	1061	902/842	12/119
7	1	17 FEB	1024-1056	58 50.8 N	164 48.1 E	2.8	-0.2	410	721	332/290	50/238
8	1	17 FEB	2235-2336	59 0.6 N	165 29.0 E	---	-0.4	497	1526	15/9	7/325
9	1	18 FEB	0636-0646	59 19.0 N	165 46.1 E	-0.7	-1.6	125	153	1976/6756	162/267
10	1	18 FEB	1600-1612	59 29.8 N	166 28.2 E	1.4	-0.7	125	151	0/0	15000/21569
11	1	19 FEB	0329-0359	59 44.6 N	166 53.5 E	0.4	-0.2	206	268	33/46	17/4
**12	2	21 FEB	1752-1833	60 39.8 N	172 38.6 E	3.6	1.0	472	472	252/187	234/219
**13	2	22 FEB	2048-2155	61 5.2 N	174 42.4 E	2.2	1.0	420	420	587/680	1205/476
14	3	27 FEB	1407-1412	54 14.0 N	166 7.0 W	3.8	3.5	278	368	1191/971	0/0
15	3	27 FEB	1756-1809	54 16.2 N	166 8.1 W	---	3.5	---	657	33/19	48/829
16	3	28 FEB	0142-0213	54 27.6 N	166 25.9 W	3.7	3.8	466	529	614/613	19/727
*17	3	28 FEB	1453-1549	54 27.4 N	166 59.9 W	4.0	3.7	300	497	0/0	1/202
18	3	28 FEB	2149-2206	53 49.5 N	167 17.0 W	3.8	3.5	300	457	373/259	14/4
19	3	1 MAR	0341-0441	54 14.3 N	167 16.8 W	3.8	3.5	505	1628	307/125	10/594
20	3	1 MAR	1855-1900	53 38.9 N	167 51.5 W	3.7	3.5	486	813	420/174	40/250
21	3	1 MAR	2321-2338	53 49.2 N	167 50.8 W	4.0	3.5	372	1650	8850/3234	0/0
22	3	2 MAR	1259-1306	53 44.4 N	168 9.4 W	3.8	3.6	344	1174	1143/576	1/2
23	3	3 MAR	0635-0639	53 51.6 N	167 57.4 W	4.0	3.5	339	1387	1844/965	7/4
24	3	3 MAR	0008-0038	53 27.5 N	168 45.0 W	3.9	3.7	437	1187	904/327	18/107
25	3	4 MAR	1814-1820	53 17.1 N	169 19.0 W	4.0	3.6	306	1631	5060/1945	0/0
26	4	6 MAR	0527-0603	56 37.8 N	172 33.5 W	3.3	3.0	129	153	T/5	7/11
27	4	6 MAR	1035-1042	56 42.7 N	172 8.2 W	---	1.9	97	130	28/23	38/18
28	4	6 MAR	1521-1525	56 49.8 N	171 31.6 W	3.0	2.2	110	120	2843/4704	20/6
**29	4	6 MAR	1925-1944	56 53.6 N	170 53.3 W	3.0	2.0	109	109	889/395	750/788
30	4	7 MAR	0604-0634	56 14.6 N	170 6.5 W	2.9	2.1	104	119	3738/1578	311/147

Table 1. (cont.) Summary of trawl stations and catch data from the winter 1993 EIMWT survey of the Bering Sea, Miller Freeman cruise 93-1.

HAUL NO.	AREA	DATE (1993)	TIME (AST)	START POSITION LAT.	START POSITION LONG.	TEMP (C) GEAR	TEMP (C) SURF	DEPTH (M) GEAR	DEPTH (M) BOTM	CATCH (LBS/NOS.) POLLOCK	CATCH (LBS/NOS.) OTHER
31	4	7 MAR	2013-2028	56 25.1 N	167 51.2 W	3.2	2.2	108	135	4066/4502	37/4
32	4	8 MAR	0507-0537	56 8.4 N	168 34.0 W	3.6	2.3	148	382	1157/1322	15/7
33	4	8 MAR	0857-0916	56 5.8 N	168 49.9 W	3.5	2.8	547	748	228/130	31/539
**34	4	9 MAR	0506-0522	56 18.8 N	165 26.6 W	1.6	1.9	92	92	26/15	4324/7450
35	4	9 MAR	1216-1226	55 55.9 N	165 55.0 W	3.3	2.6	93	120	1683/1919	189/9
**36	4	9 MAR	1502-1517	55 50.6 N	166 9.8 W	3.6	2.4	128	128	323/346	596/438
37	4	10 MAR	0604-0622	55 1.6 N	166 35.9 W	2.8	3.0	103	144	9/8	7/1
38	4	10 MAR	0937-0946	55 8.9 N	166 19.5 W	3.7	2.7	132	141	6382/7521	68/16
39	4	10 MAR	1636-1640	55 28.1 N	165 26.0 W	4.4	2.6	111	117	5027/5684	93/10
40	4	11 MAR	0429-0459	55 31.0 N	163 43.6 W	2.5	2.3	44	77	6058/2511	1392/--
41	4	11 MAR	0905-0910	55 20.2 N	164 14.1 W	1.8	2.4	89	100	1263/1203	3817/--
42	4	11 MAR	1618-1651	55 55.0 N	165 10.4 W	2.8	2.3	109	116	1651/1668	3339/12
43	3	12 MAR	0310-0327	54 8.2 N	167 51.2 W	4.4	3.8	358	1739	2312/959	18/25

Area 1 represents the western Bering Sea shelf/slope west of Cape Olyutorsky
Area 2 represents the western Bering Sea shelf/slope east of Cape Olyutorsky
Area 3 represents the Bogoslof Island area
Area 4 represents the southeastern Bering Sea shelf/slope

** Indicates bottom trawls
* Indicates Marinovich trawls
T Indicates trace amount

Table 2. Summary of catch by species in 10 midwater rope trawls from the western Bering Sea shelf and slope west of Cape Olyutorsky during the winter 1993 EIMWT survey, Miller Freeman cruise 93-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Pacific Herring (Clupea pallasi)	15,014.9	71.8	21,797	58.6
Walleye Pollock (Theragra chalcogramma)	5,587.2	26.7	14,419	38.8
Pacific Cod (Gadus macrocephalus)	221.1	1.1	44	0.1
Giant Grenadier (Albatrossia pectoralis)	50.7	0.2	4	<.1
Jellyfish Unidentified (Scyphozoa)	17.5	0.1	6	<.1
Lanternfish Unidentified (Myctophidae)	4.9	<.1	336	0.9
Garnet Lampfish (Stenobrachius nannochir)	3.3	<.1	229	0.6
Stenobrachius sp. (Myctophidae)	2.4	<.1	133	0.4
Northern Smoothtongue (Leuroglossus schmidti)	2.1	<.1	111	0.3
Squid Unidentified (Teuthoidea)	2.1	<.1	20	0.1
Broadfin Lanternfish (Lampanyctus ritteri)	1.5	<.1	42	0.1
Sculpin Unidentified (Cottidae)	1.5	<.1	4	<.1
Magistrate Armhook Squid (Berryteuthis magister)	0.8	<.1	17	<.1
Blacksmelt Unidentified (Bathylagus sp.)	0.8	<.1	14	<.1
Deepsea Smelt Unidentified (Bathylagidae)	0.7	<.1	13	<.1
Pacific Viperfish (Chauliodus macouni)	0.6	<.1	7	<.1
Salps Unidentified (Thaliacea)	0.4	<.1	5	<.1
Duckbill Barracudina (Paralepis atlantica)	0.3	<.1	1	<.1
Shrimp Unidentified (Natantia)	0.1	<.1	6	<.1
Capelin (Mallotus villosus)	0.1	<.1	1	<.1
Sergestid Shrimp Unidentified (Sergestidae)	0.1	<.1	1	<.1
Totals	20,913.1	100.0	37,210	100.0

Table 3. Summary of catch by species in 2 bottom trawls from the western Bering Sea shelf and slope east of Cape Olyutorsky during the winter 1993 EIMWT survey, Miller Freeman cruise 93-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Walleye Pollock (Theragra chalcogramma)	838.0	36.8	867	55.5
Rock Sole (Pleuronectes bilineatus)	599.0	26.3	390	25.0
Pacific Halibut (Hippoglossus stenolepis)	267.5	11.7	41	2.6
Starry Skate (Raja stellulata)	221.0	9.7	12	0.8
Alaska Plaice (Pleuronectes quadrituberculatus)	157.5	6.9	60	3.8
Pacific Cod (Gadus macrocephalus)	54.0	2.4	12	0.8
Snailfish Unidentified (Cyclopteridae)	47.0	2.1	32	2.0
Yellow Irish Lord (Hemilepidotus jordani)	23.0	1.0	30	1.9
Greenland Turbot (Reinhardtius hippoglossoides)	22.5	1.0	3	0.2
Shortraker Rockfish (Sebastes borealis)	18.5	0.8	2	0.1
Spinyhead Sculpin (Dasycottus setiger)	7.7	0.3	19	1.2
Arrowtooth Flounder (Atheresthes stomias)	4.0	0.2	1	0.1
Flathead Sole (Hippoglossoides elassodon)	3.6	0.2	2	0.1
Longnose Poacher (Sarritor leptorhynchus)	3.5	0.2	26	1.7
Sea Anemone Unidentified (Actiniaria)	2.5	0.1	6	0.4
Twoline Eelpout (Bothrocara brunneum)	2.0	0.1	3	0.2
Squid Unidentified (Teuthoidea)	1.8	0.1	4	0.3
Sidestripe Shrimp (Pandalopsis dispar)	1.5	0.1	34	2.2
Opilio Tanner Crab (Chionoecetes opilio)	1.2	0.1	5	0.3
Sea Urchin Unidentified (Echinoidea)	0.3	<.1	3	0.2
Pacific Lamprey (Lampetra tridentata)	0.3	<.1	1	0.1
Roughspine Sculpin (Triglops macellus)	0.3	<.1	1	0.1
Shrimp Unidentified (Natantia)	0.2	<.1	6	0.4
Thorny Sculpin (Icelus spiniger)	0.2	<.1	1	0.1
Darkblotched Rockfish (Sebastes crameri)	0.1	<.1	1	0.1
Totals	2,277.2	100.0	1,562	100.0

Table 4. Summary of catch by species in 13 midwater rope trawls from the southeastern Aleutian Basin near Bogoslof Island during the winter 1993 EIMWT survey, Miller Freeman cruise 93-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Walleye Pollock (Theragra chalcogramma)	23,048.9	99.2	10,167	79.2
Smooth Lumpsucker (Aptocyclus ventricosus)	95.9	0.4	32	0.2
Jellyfish Unidentified (Scyphozoa)	19.0	0.1	--	---
Greenland Turbot (Reinhardtius hippoglossoides)	15.6	0.1	1	<.1
Lanternfish Unidentified (Myctophidae)	13.0	0.1	1,012	7.9
Pacific Lamprey (Lampetra tridentata)	7.0	<.1	9	0.1
Northern Smoothtongue (Leuroglossus schmidti)	6.4	<.1	1,111	8.7
Chinook Salmon (Oncorhynchus tshawytscha)	6.0	<.1	1	<.1
Squid Unidentified (Teuthoidea)	3.2	<.1	24	0.2
Northern Lampfish (Stenobrachius leucopsarus)	3.1	<.1	365	2.8
Pacific Ocean Perch (Sebastes alutus)	3.0	<.1	1	<.1
Coryphaenoides sp. (Macrouridae)	1.0	<.1	1	<.1
Blacksmelt Unidentified (Bathylagidae)	0.5	<.1	13	0.1
Shrimp Unidentified (Natantia)	0.4	<.1	--	---
Brokenline Lampfish (Lampanyctus jordani)	0.3	<.1	3	<.1
Bigscale Unidentified (Melamphaidae)	0.3	<.1	3	<.1
Salps Unidentified (Thaliacea)	0.2	<.1	59	0.5
Pacific Viperfish (Chauliodus macouni)	0.1	<.1	1	<.1
Stenobrachius sp. (Myctophidae)	0.1	<.1	26	0.2
Protomyctophum sp. (Myctophidae)	0.1	<.1	5	<.1
Euphausiid Unidentified (Euphausiacea)	0.1	<.1	--	---
Totals	23,224.2	100.0	12,834	100.0

Table 5. Summary of catch by species in 14 midwater rope trawls from the eastern Bering Sea shelf during the winter 1993 EIMWT survey, Miller Freeman cruise 93-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Walleye Pollock (Theragra chalcogramma)	34,131.4	78.5	32,778	97.8
Jellyfish Unidentified (Scyphozoa)	8,834.6	20.3	--	---
Smooth Lumpsucker (Aptocyclus ventricosus)	212.3	0.5	49	0.1
Pacific Cod (Gadus macrocephalus)	141.3	0.3	24	0.1
Flathead Sole (Hippoglossoides elassodon)	97.6	0.2	110	0.3
Big Skate (Raja binoculata)	27.5	0.1	1	<.1
Rock Sole (Pleuronectes bilineatus)	19.5	<.1	12	<.1
Pacific Lamprey (Lampetra tridentata)	5.3	<.1	8	<.1
Opilio Tanner Crab (Chionoecetes opilio)	5.0	<.1	5	<.1
Bairdi Tanner Crab(Chionoecetes bairdi)	4.0	<.1	3	<.1
Pacific Halibut (Hippoglossus stenolepis)	3.8	<.1	1	<.1
Squid Unidentified (Teuthoidea)	3.2	<.1	39	0.1
Northern Smoothtongue (Leuroglossus schmidti)	2.5	<.1	219	0.7
Lanternfish Unidentified (Myctophidae)	2.3	<.1	277	0.8
Spinyhead Sculpin (Dasycottus setiger)	2.3	<.1	1	<.1
Prowfish (Zaprora silenus)	1.0	<.1	1	<.1
Sea Anemone Unidentified (Actiniaria)	0.5	<.1	2	<.1
Totals	43,494.1	100.0	33,530	100.0

*Haul 30, which touched bottom briefly during the trawl, caught some species that are normally found only on or near bottom.

Table 6. Summary of catch by species in 3 bottom trawls from the eastern Bering Sea shelf during the winter 1993 EIMWT survey, Miller Freeman cruise 93-1.

Species	Weight (lbs.)	Percent	Numbers	Percent
Yellowfin Sole (Pleuronectes asper)	4,002.8	57.9	7,252	76.9
Walleye Pollock (Theragra chalcogramma)	1,237.5	17.9	756	8.0
Flathead Sole (Hippoglossoides elassodon)	300.6	4.4	316	3.4
Yellow Irish Lord (Hemilepidotus jordani)	295.3	4.3	147	1.6
Jellyfish Unidentified (Scyphozoa)	194.8	2.8	---	---
Pacific Cod (Gadus macrocephalus)	173.5	2.5	81	0.9
Rock Sole (Pleuronectes bilineatus)	164.5	2.4	251	2.7
Alaska Plaice (Pleuronectes quadrituberculatus)	130.4	1.9	89	0.9
Pacific Halibut (Hippoglossus stenolepis)	103.3	1.5	9	0.1
Big Skate (Raja binoculata)	65.0	0.9	7	0.1
Arrowtooth Flounder (Atheresthes stomias)	55.2	0.8	50	0.5
Opilio Tanner Crab (Chionoecetes opilio)	53.4	0.8	174	1.8
Bairdi Tanner Crab (Chionoecetes bairdi)	22.8	0.3	51	0.5
Giant Octopus (Octopus dofleini)	21.0	0.3	1	<.1
Miscellaneous Invertebrates	15.0	0.2	--	---
Sea Anemone Unidentified (Actiniaria)	11.6	0.2	35	0.4
Sturgeon Poacher (Podothecus acipenserinus)	10.6	0.2	56	0.6
Hermit Crab Unidentified (Paguridae)	10.4	0.2	52	0.6
Starfish Unidentified (Asteroidea)	9.3	0.1	26	0.3
Sablefish (Anoplopoma fimbria)	8.0	0.1	1	<.1
Neptunea Sp. (Buccinidae)	6.9	0.1	36	0.4
Rex Sole (Errex zachirus)	3.0	<.1	6	0.1
Smooth Lumpsucker (Aptocyclus ventricosus)	3.0	<.1	1	<.1
Searcher (Bathymaster signatus)	2.5	<.1	4	<.1
Plain Sculpin (Myoxocephalus jaok)	2.5	<.1	2	<.1
Basketstarfish Unidentified (Gorgonocephalidae)	2.3	<.1	4	<.1
Fusitriton Sp. (Ranellidae)	1.1	<.1	5	0.1
North Pacific Toad Crab (Hyas lyratus)	0.8	<.1	7	0.1
Circumboreal Toad Crab (Hyas coarctatus)	0.3	<.1	3	<.1
Spinyhead Sculpin (Dasycottus setiger)	0.3	<.1	2	<.1
Green Sea Urchin (Strongylocentrotus droebachiensis)	0.3	<.1	1	<.1
Snail Egg Unidentified	0.2	<.1	1	<.1
Totals	6,908.2	100.0	9,426	100.0

Table 7. Summary of the number of pollock biological samples and measurements from the winter 1993 EIMWT survey of the western Bering sea shelf and slope, Miller Freeman cruise 93-1.

	United States							Russia	China
HAUL NO.	LENGTH	MATURITY	OTOLITH	FISH WGT	OVARY WGT	STOMACH	GENETIC	SCALE & OTOLITH	OTOLITH
1	29	29	29	29	10	20	0	0	0
2	251	100	100	100	35	5	0	120	0
3	383	100	100	100	0	21	4	120	20
4	222	15	15	15	0	6	2	0	0
5	437	96	96	96	7	11	0	120	0
6	339	100	100	100	20	8	22	0	20
7	290	93	93	93	22	19	0	0	0
8	9	0	0	0	0	0	0	0	0
9	287	101	101	101	0	3	14	0	10
10	0	0	0	0	0	0	0	0	0
11	46	45	45	45	1	0	1	0	0
12	187	129	129	0	0	0	17	0	0
13	680	118	118	0	0	1	22	150	30
14	332	69	69	0	0	20	0	20	0
15	0	0	0	0	0	0	0	0	0
16	405	104	104	104	5	22	0	0	20
17	0	0	0	0	0	0	0	0	0
18	259	80	80	80	14	7	25	20	0
19	125	110	110	110	90	13	0	0	15
20	174	99	99	99	73	20	0	20	0
21	315	100	100	100	95	10	25	0	20
22	331	112	112	112	6	20	0	20	0
23	383	105	105	105	82	15	25	20	25
24	136	104	104	104	87	20	0	0	24
25	387	99	95	0	69	20	0	20	0
26	5	0	0	0	0	0	0	0	0
27	27	23	23	23	9	11	0	0	0
28	422	118	118	118	16	20	0	20	0
29	293	102	102	102	52	20	0	20	0
30	354	108	108	108	69	21	0	0	25
31	322	80	80	80	22	20	0	10	0
32	577	76	76	76	13	19	0	0	0
33	130	91	91	91	58	14	0	0	0
34	15	15	15	15	4	9	0	0	0
35	611	88	88	88	22	20	0	20	0
36	346	8	8	8	4	0	0	0	0
37	8	8	8	8	2	6	0	0	0
38	424	82	82	82	11	4	0	0	20
39	489	82	0	0	0	20	0	0	0
40	317	181	181	181	144	19	25	0	0
41	374	89	89	89	27	20	0	20	20
42	297	143	0	0	0	20	25	0	0
43	326	107	107	107	96	19	0	0	20
Total	11344	3309	3080	2669	1165	523	207	720	269

Table 8. Inventory of CTD casts, Miller Freeman cruise 93-1.

CAST	HAUL	DATE (1993)	TIME (AST)	POSITION LAT (N)	POSITION LONG	DEPTH (m) CAST/BOTM	COMMENTS
1	-	Jan 16	0700	48 08.8	122 24.8W	100/108	cal Port Susan
2	-	Jan 26	0946	53 49.4	166 23.9W	47/49	cal Beaver Inlet
3	-	Feb 2	0616	53 47.2	168 18.1W	817/1695	Bogoslof intercal
4	-	Feb 4	1803	53 49.9	168 14.6W	748/1650	Bogoslof intercal
5	-	Feb 5	0728	53 44.7	166 53.5W	83/98	cal Makushin Bay
6	2	Feb 15	1642	57 07.0	163 28.6E	615/1145	WBS Tr. 2.0
7	3,4	Feb 16	0228	57 50.7	163 39.6E	113/126	WBS Tr. 4.1
8	6	Feb 17	0458	58 37.0	164 26.8E	789/885	WBS Tr. 7.0
9	9	Feb 18	0729	59 19.3	165 45.3E	132/145	WBS Tr. 10.0
10	11	Feb 19	0446	59 44.3	166 54.2E	258/275	WBS Tr. 12.0
11	14,15	Feb 27	1533	54 15.5	166 07.2W	549/577	Bogoslof Tr. 1.0
12	16	Feb 28	0319	54 27.9	166 25.3W	511/525	Bogoslof Tr. 2.0
13	17	Feb 28	1252	54 28.6	166 59.9W	478/487	Bogoslof Tr. 4.0
14	18	Feb 28	2254	53 50.6	167 16.7W	429/450	Bogoslof Tr. 5.0
15	19	Mar 1	0603	54 14.2	167 16.8W	687/1554	Bogoslof Tr. 5.0
16	20	Mar 1	1957	53 38.5	167 51.5W	637/780	Bogoslof Tr. 7.0
17	21,23	Mar 2	0052	53 49.2	167 49.0W	642/1635	Bogoslof Tr. 7.0
18	22	Mar 2	1557	53 44.5	168 08.0W	691/1237	Bogoslof Tr. 8.0
19	24	Mar 4	0138	53 26.5	168 46.8W	641/1196	Bogoslof Tr. 10.0
20	25	Mar 4	1916	53 17.8	169 17.2W	550/1654	Bogoslof Tr. 12.0
21	28	Mar 6	1621	56 49.9	171 31.2W	99/114	EBS Tr. 1.0
22	30	Mar 7	0736	56 15.5	170 04.2W	96/112	EBS Tr. 3.0
23	31	Mar 7	2132	56 24.6	167 57.2W	115/127	EBS Tr. 4.0
24	32	Mar 8	0622	56 08.3	168 36.3W	366/390	EBS Tr. 4.0
25	33	Mar 8	1021	56 05.3	168 51.5W	636/722	EBS Tr. 4.0
26	36	Mar 9	1557	55 50.2	166 08.5W	107/119	EBS Tr. 6.0
27	38	Mar 10	1109	55 08.7	166 19.0W	122/135	EBS Tr. 7.0
28	40	Mar 11	0550	55 30.8	163 43.7W	69/80	EBS Tr. 8.0
29	42	Mar 11	1732	55 00.0	165 07.9W	98/108	EBS Tr. 8.0

Tr. = Transect

Table 9. Inventory of XBT drops, Miller Freeman cruise 93-1.

DROP NO.	PROBE	HAUL	DATE (1993)	TIME (AST)	POSITION LAT (N)	POSITION LONG	BOTTOM DEPTH(m)	COMMENTS
1	T-6	-	Jan 24	1303	54 15.3	159 12.5 W	2104	XBT Test
2	T-5	-	Jan 25	1651	52 13.6	164 51.7 W	4716	Gear Test
3	T-6	1	Feb 12	1918	52 02.0	176 37.5 W	1000	Adak Is.
4	T-7	-	Feb 14	0658	53 50.5	170 20.8 E	3805	WBS Tr. 1.0
5	T-7	-	Feb 14	1457	54 55.6	168 47.6 E	3682	WBS Tr. 1.0
6	T-7	-	Feb 14	2122	55 45.3	166 53.5 E	3881	WBS Tr. 1.0
7	T-7	-	Feb 15	0205	55 59.6	165 33.3 E	3535	WBS Tr. 1.0
8	T-7	-	Feb 15	0256	56 06.0	165 18.3 E	3493	WBS Tr. 1.0
9	T-7	-	Feb 15	0357	56 14.1	164 59.6 E	3579	WBS Tr. 1.0
10	T-7	-	Feb 15	0426	56 17.8	164 51.1 E	3634	WBS Tr. 1.0
11	T-7	-	Feb 15	0453	56 21.4	164 42.7 E	3706	WBS Tr. 1.0
12	T-7	-	Feb 15	0521	56 25.1	164 34.3 E	3743	WBS Tr. 1.0
13	T-6	-	Feb 15	0549	56 28.7	164 26.0 E	3747	WBS Tr. 1.0
14	T-6	-	Feb 15	0620	56 32.7	164 16.5 E	3658	WBS Tr. 1.0
15	T-6	-	Feb 15	0705	56 38.4	164 03.0 E	3412	WBS Tr. 1.0
16	T-6	-	Feb 15	0752	56 44.8	163 48.2 E	2812	WBS Tr. 1.0
17	T-6	-	Feb 15	0848	56 52.1	163 31.0 E	2620	WBS Tr. 1.0
18	*** DROP NO GOOD ***							
19	T-4	-	Feb 16	1124	58 06.1	163 35.5 E	87	WBS Tr. 5.0
20	T-4	-	Feb 16	1153	58 02.5	163 44.2 E	183	WBS Tr. 5.0
21	T-7	5	Feb 16	1443	57 58.7	163 53.3 E	750	WBS Tr. 5.0
22	T-7	-	Feb 16	1515	57 55.0	164 02.1 E	3055	WBS Tr. 5.0
23	T-7	-	Feb 16	1619	57 46.9	164 21.2 E	3233	WBS Tr. 5.0
24	T-7	-	Feb 16	1720	57 39.4	164 38.6 E	3337	WBS Tr. 5.0
25	T-4	7	Feb 17	1209	58 51.7	164 46.9 E	100	WBS Tr. 8.0
26	T-7	-	Feb 17	1240	58 48.0	164 55.9 E	1666	WBS Tr. 8.0
27	T-7	-	Feb 17	1309	58 44.3	165 04.7 E	3462	WBS Tr. 8.0
28	T-7	-	Feb 17	1339	58 40.7	165 13.4 E	3545	WBS Tr. 8.0
29	T-7	-	Feb 17	1448	58 32.5	165 33.4 E	3593	WBS Tr. 8.0
30	T-7	-	Feb 17	1551	58 25.0	165 51.1 E	3614	WBS Tr. 8.0
31	*** DROP NO GOOD ***							
32	T-4	-	Feb 18	1341	59 34.1	166 19.6 E	121	WBS Tr. 11.0
33	T-4	10	Feb 18	1414	59 29.9	166 28.5 E	145	WBS Tr. 11.0
34	T-4	-	Feb 18	1447	59 26.1	166 37.2 E	315	WBS Tr. 11.0
35	*** DROP NO GOOD ***							
36	T-7	-	Feb 18	1855	59 21.1	166 48.2 E	720	WBS Tr. 11.0
37	T-7	-	Feb 18	2000	59 14.4	167 03.1 E	1479	WBS Tr. 11.0
38	T-5	-	Feb 18	2113	59 05.0	167 21.9 E	3433	WBS Tr. 11.0
39	T-7	-	Feb 19	1417	59 59.5	168 12.7 E	567	WBS Tr. 14.0
40	T-7	-	Feb 19	1503	59 55.5	168 21.7 E	723	WBS Tr. 14.0
41	*** DROP NO GOOD ***							
42	T-7	-	Feb 19	1555	59 50.8	168 32.2 E	2630	WBS Tr. 14.0
43	T-7	-	Feb 19	1631	59 47.7	168 39.6 E	2625	WBS Tr. 14.0
44	T-7	-	Feb 19	1757	59 39.0	168 59.0 E	2830	WBS Tr. 14.0
45	T-7	-	Feb 19	1915	59 31.0	169 16.7 E	2680	WBS Tr. 14.0
46	T-7	-	Feb 19	2107	59 19.9	169 42.7 E	2262	WBS Tr. 14.0
47	T-4	-	Feb 20	1918	60 10.7	170 52.2 E	107	WBS Tr. 16.0
48	T-7	-	Feb 20	1952	60 06.6	171 01.0 E	1016	WBS Tr. 16.0

Table 9. (cont.)

DROP NO.	PROBE	HAUL	DATE (1993)	TIME (AST)	POSITION LAT (N)	POSITION LONG	BOTTOM DEPTH(m)	COMMENTS
49	T-7	-	Feb 20	2024	60 02.6	171 09.7 E	1825	WBS Tr. 16.0
50	T-7	-	Feb 20	2057	59 58.5	171 18.5 E	2695	WBS Tr. 16.0
51	T-7	-	Feb 20	2209	59 49.5	171 37.1 E	2995	WBS Tr. 16.0
52	T-7	-	Feb 20	2317	59 41.3	171 54.3 E	3108	WBS Tr. 16.0
53	T-4	-	Feb 21	1329	60 43.6	172 39.0 E	120	WBS Tr. 17.1
54	T-7	12	Feb 21	1539	60 39.5	172 47.5 E	1312	WBS Tr. 18.0
55	T-7	-	Feb 21	2044	60 35.2	172 56.2 E	1575	WBS Tr. 18.0
56	*** DROP NO GOOD ***							
57	T-7	-	Feb 21	2127	60 30.2	173 06.5 E	1912	WBS Tr. 18.0
58	T-7	-	Feb 21	2237	60 21.8	173 23.2 E	1616	WBS Tr. 18.0
59	T-7	-	Feb 21	2346	60 13.2	173 40.3 E	2762	WBS Tr. 18.0
60	*** DROP NO GOOD ***							
61	T-4	-	Feb 22	1820	61 12.8	174 33.8 E	96	WBS Tr. 20.0
62	T-4	-	Feb 22	1854	61 08.6	174 42.6 E	248	WBS Tr. 20.0
63	*** DROP NO GOOD ***							
64	*** DROP NO GOOD ***							
65	*** DROP NO GOOD ***							
66	T-6	-	Feb 25	1226	54 43.3	170 59.7 W	3271	XBT Test
67	T-7	-	Feb 28	1808	54 06.7	167 00.1 W	1173	Bog. Tr. 4.0
68	T-7	-	Mar 1	1030	54 31.8	167 33.9 W	722	Bog. Tr. 6.0
69	T-7	-	Mar 2	0849	54 18.0	168 09.1 W	1422	Bog. Tr. 8.0
70	T-7	-	Mar 3	1742	54 09.6	168 45.0 W	2552	Bog. Tr. 10.0
71	T-7	-	Mar 4	1300	53 59.9	169 18.9 W	1875	Bog. Tr. 12.0
72	T-7	-	Mar 5	1205	53 43.5	170 13.0 W	2450	Bog. Tr. 15.0
73	T-4	-	Mar 6	0310	56 34.2	172 51.0 W	445	EBS Tr. 1.0
74	T-4	26	Mar 6	0638	56 38.6	172 29.0 W	151	EBS Tr. 1.0
75	T-7	-	Mar 7	0043	55 59.2	170 52.4 W	1881	EBS Tr. 2.0
76	T-4	-	Mar 7	1212	56 44.2	168 45.7 W	98	EBS Tr. 3.0
77	T-4	-	Mar 7	1624	56 39.0	167 18.9 W	100	EBS Tr. 3.1
78	T-7	-	Mar 8	1613	55 28.0	168 45.6 W	1814	EBS Tr. 4.1
79	T-4	-	Mar 8	2147	55 58.5	167 20.8 W	132	EBS Tr. 5.0
80	T-4	-	Mar 9	0308	56 20.0	165 40.8 W	87	EBS Tr. 5.1
81	T-4	34	Mar 9	0347	56 18.2	165 27.7 W	87	EBS Tr. 5.1
82	T-4	-	Mar 9	0956	55 59.9	165 42.2 W	102	EBS Tr. 6.0
83	T-4	35	Mar 9	1010	55 58.6	165 46.9 W	107	EBS Tr. 6.0
84	T-6	-	Mar 9	2016	55 24.5	167 19.9 W	135	EBS Tr. 6.0
85	T-6	-	Mar 10	1353	55 23.4	165 40.9 W	115	EBS Tr. 7.0
86	T-6	-	Mar 10	2209	56 00.2	164 01.6 W	87	EBS Tr. 7.0
87	T-4	-	Mar 11	0106	55 45.9	163 02.2 W	76	EBS Tr. 8.0
88	T-4	-	Mar 11	0700	55 25.3	164 02.0 W	91	EBS Tr. 8.0
89	T-6	-	Mar 11	1932	54 46.9	165 42.0 W	193	EBS Tr. 8.0
90	T-7	43	Mar 12	0409	54 08.1	167 49.7 W	1770	Bog. Tr. 7.0

Tr. = Transect

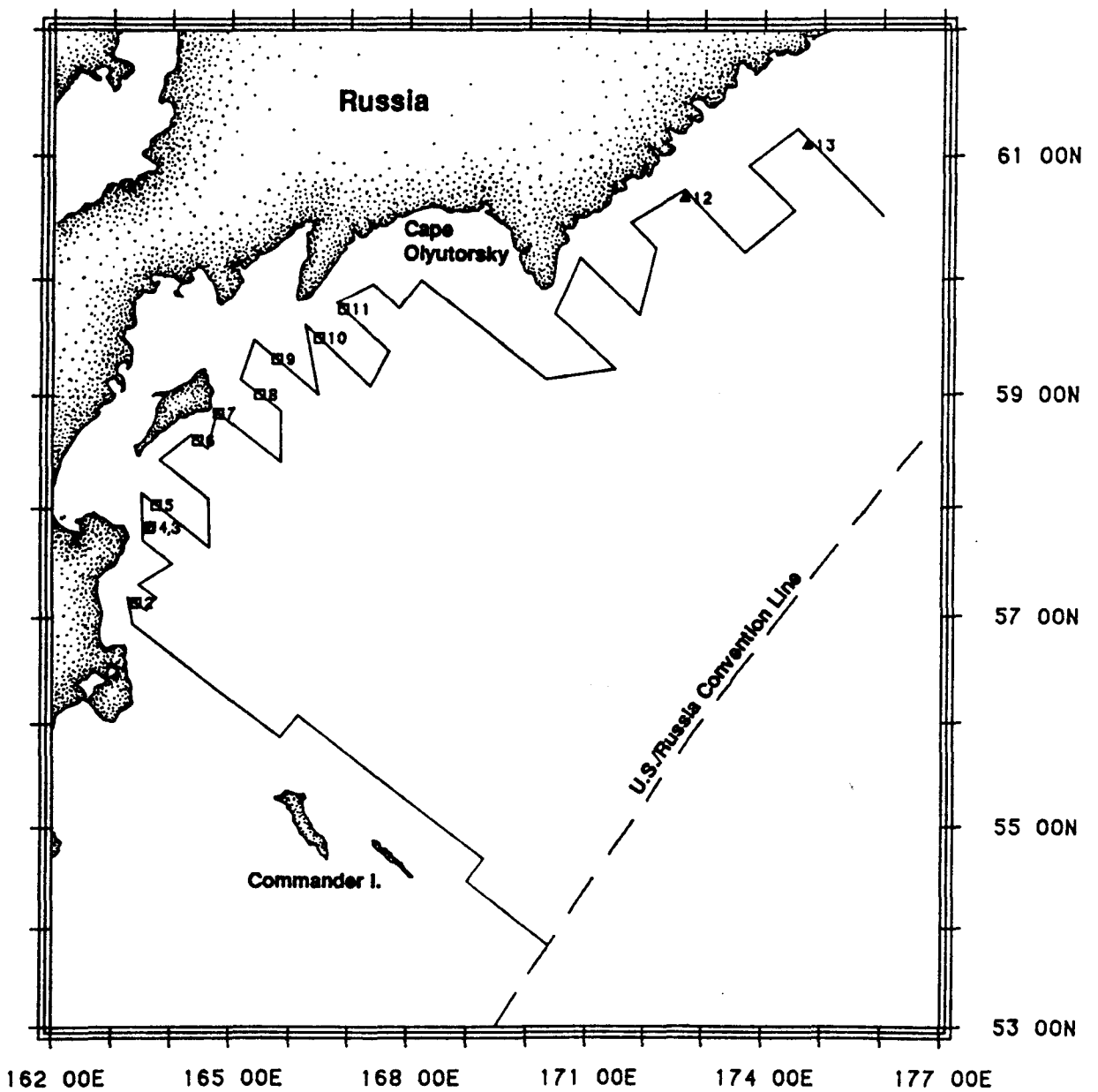

Figure 1. Survey trackline and trawl haul locations for the winter 1993 EIMWT survey of the western Bering Sea, MF93-1. Rope trawl (□); bottom trawl (△).

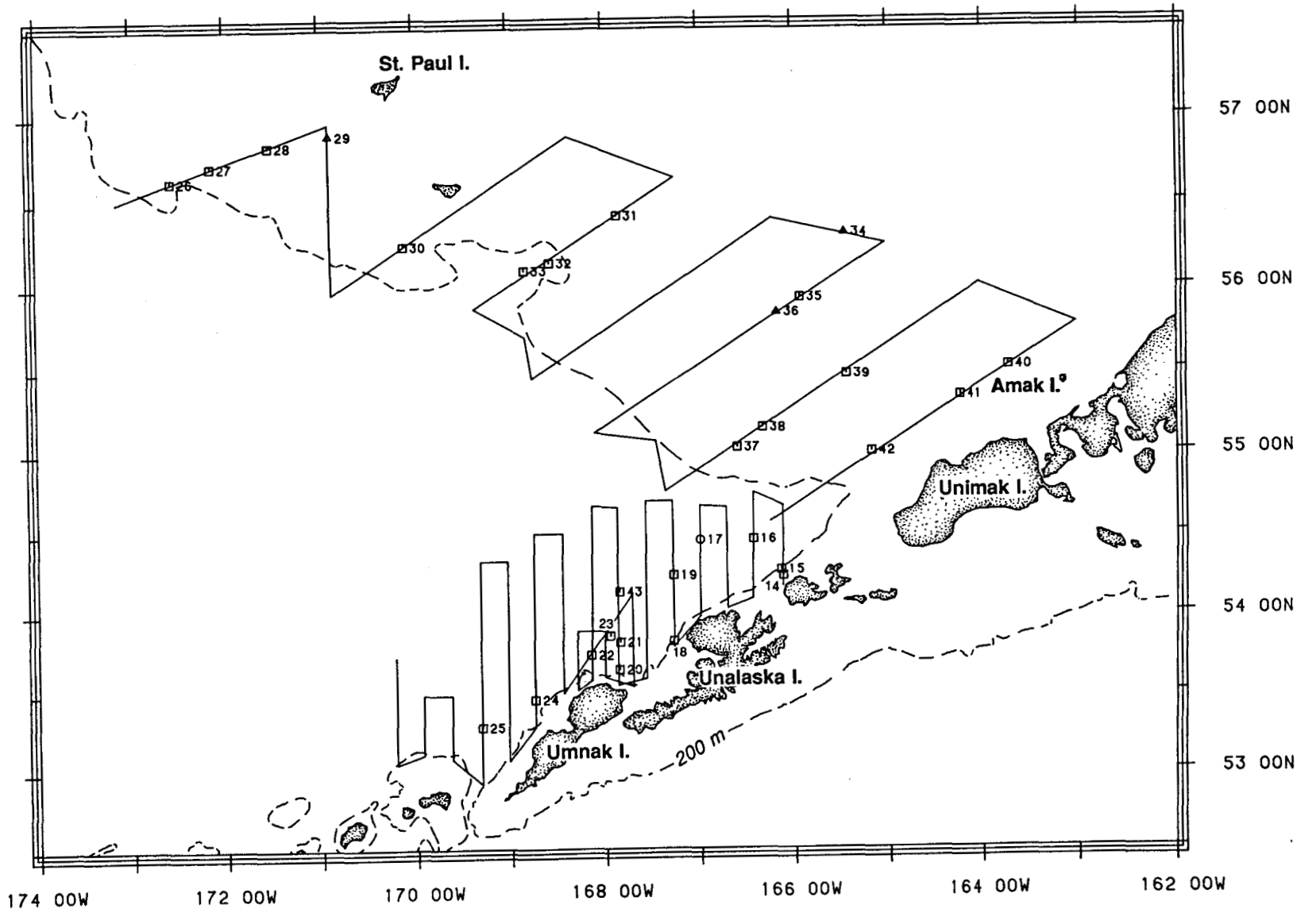

Figure 2. Survey trackline and trawl haul locations for the winter 1993 EIMWT survey of the Bogoslof Island area and the eastern Bering Sea shelf, MF93-1. Rope trawl (□), bottom trawl (▵), and Marinovich trawl (o).

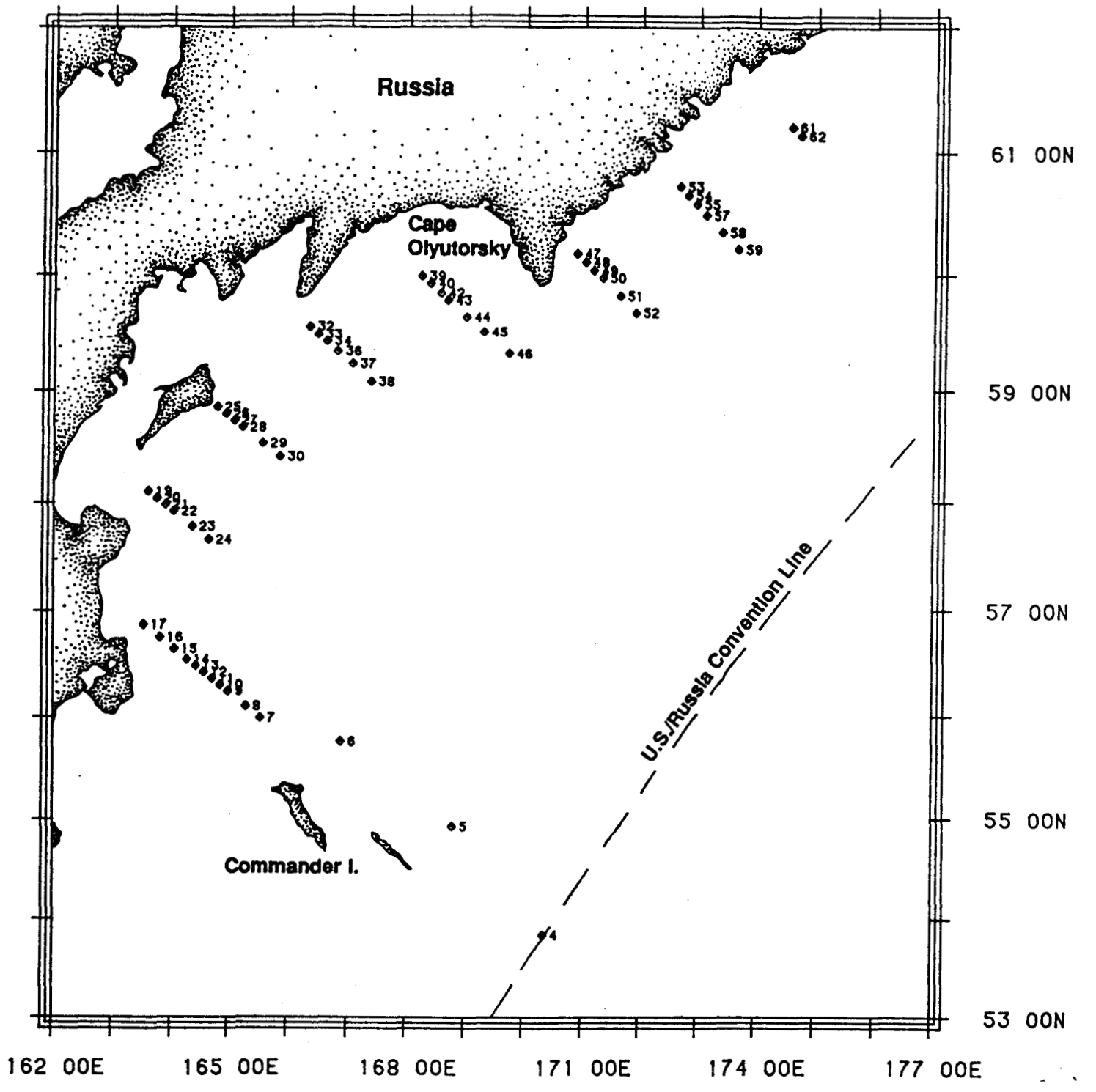

Figure 3. Locations of XBT casts for the winter 1993 EIMWT survey of the western Bering Sea, MF93-1.

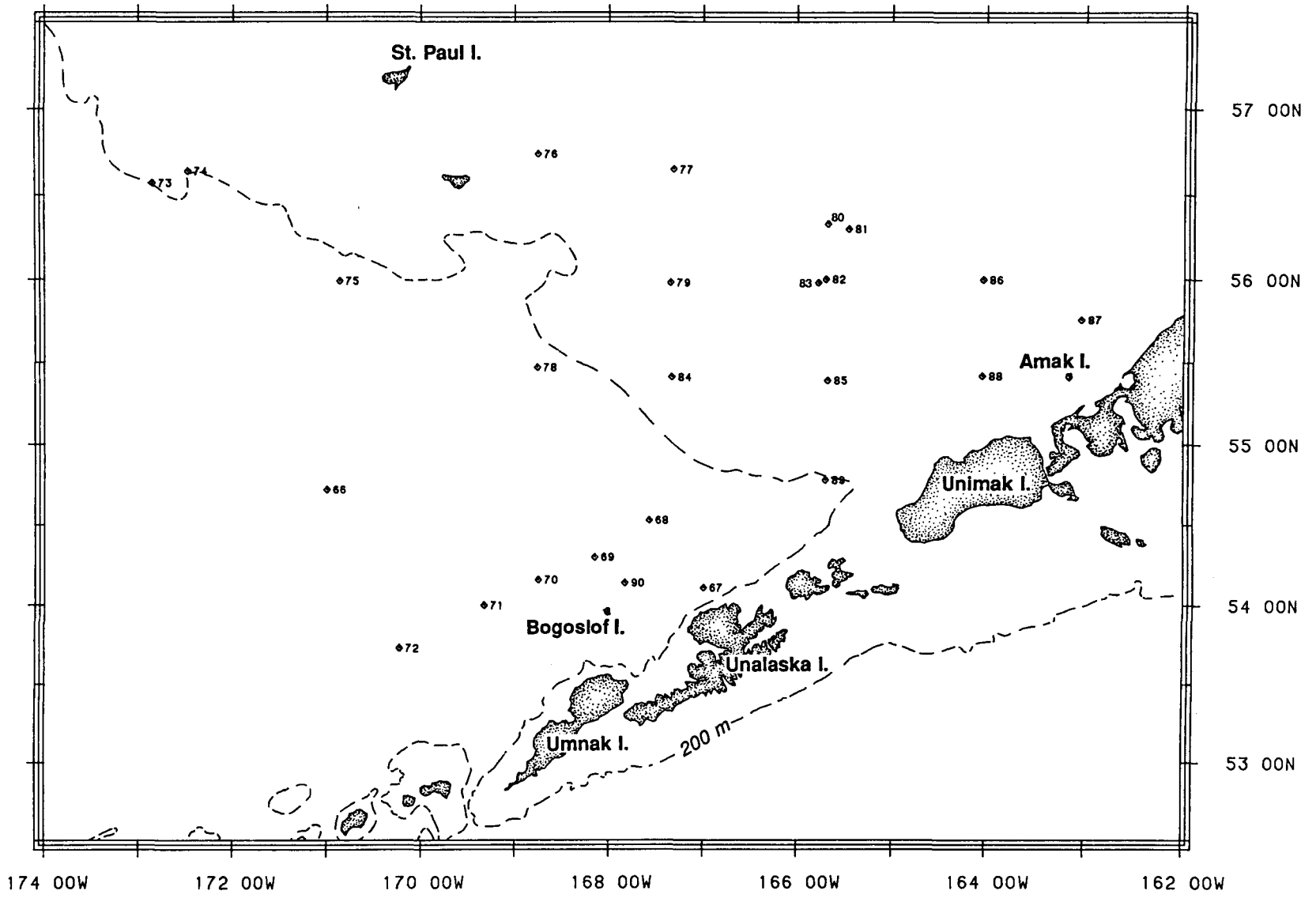

Figure 4. Locations of XBT casts for the winter 1993 EIMWT survey of the eastern Bering Sea, MF93-1.

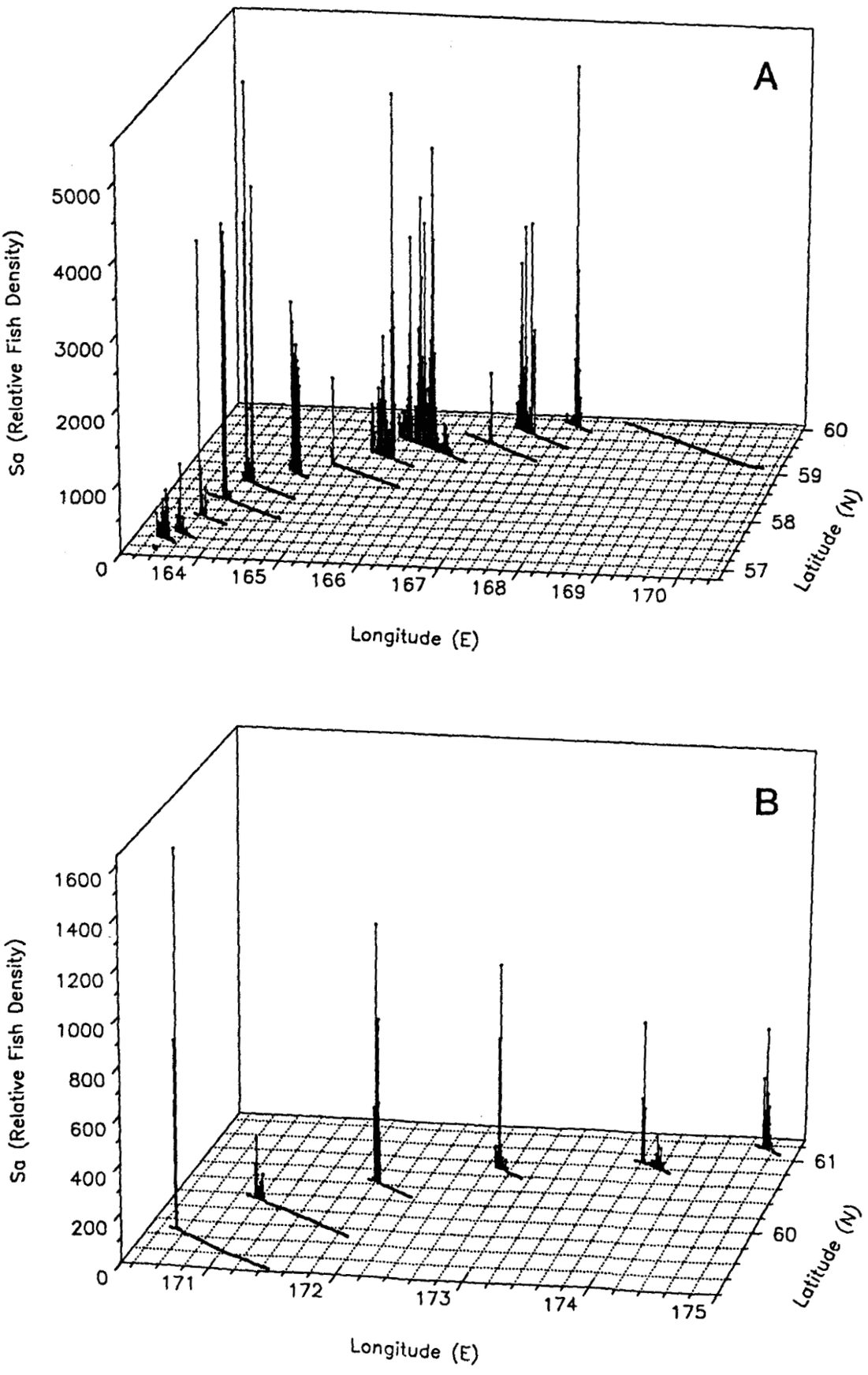

Figure 5. Relative pollock density along tracklines from the winter 1993 EIMWT survey of the western Bering Sea shelf and slope (A) south and west of Cape Olyutorsky and (B) east of Cape Olyutorsky. (Note differences in Y-axis scale.)

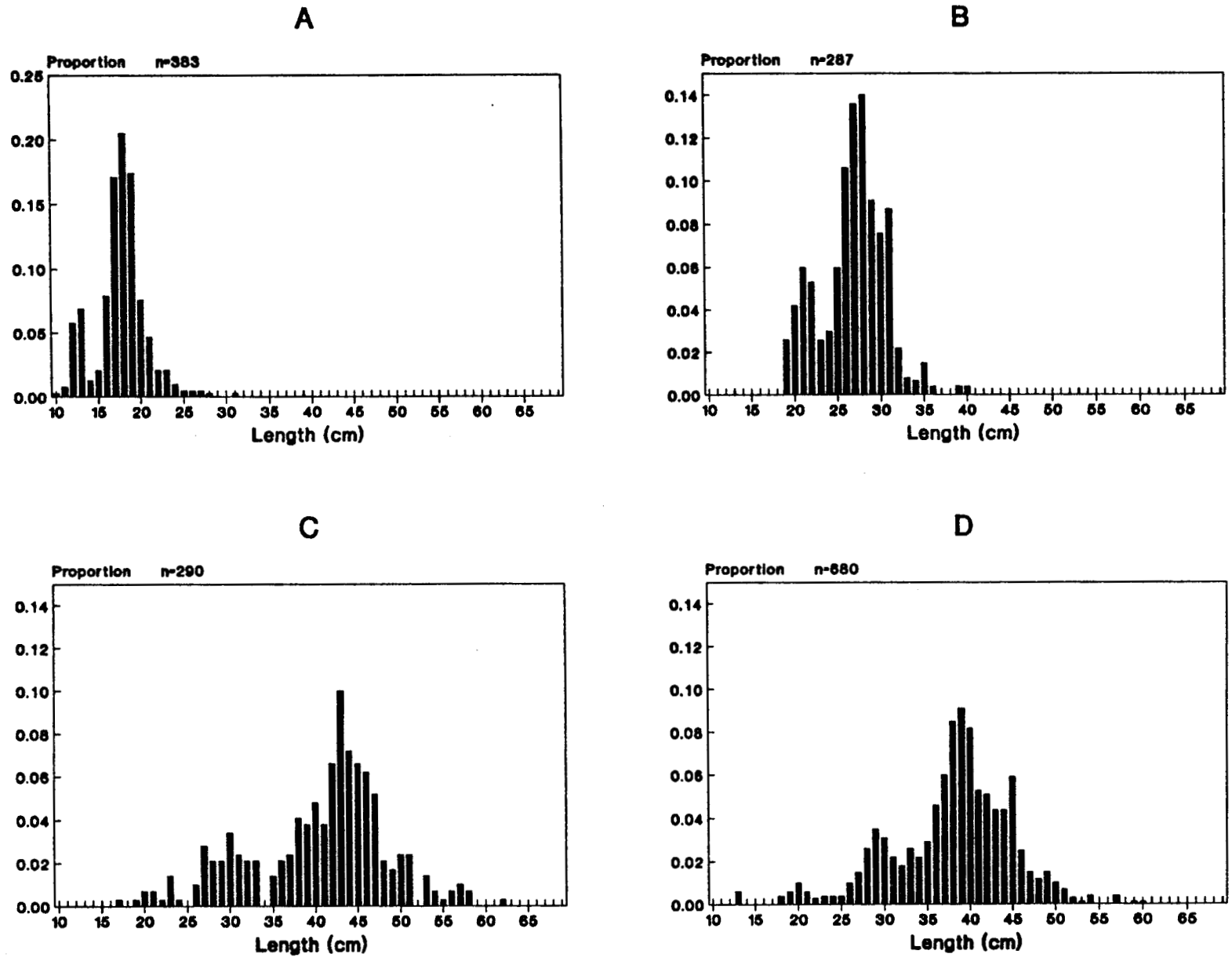

Figure 6. Preliminary pollock size compositions from midwater trawl samples A) inshore near the Gulf of Ozernoi (haul 3), B) inshore near Olyutorsky Bay (haul 9), C) offshore near Karaginsky Island (haul 7), and D) a bottom trawl sample east of Cape Olyutorsky (haul 13), in the western Bering Sea.

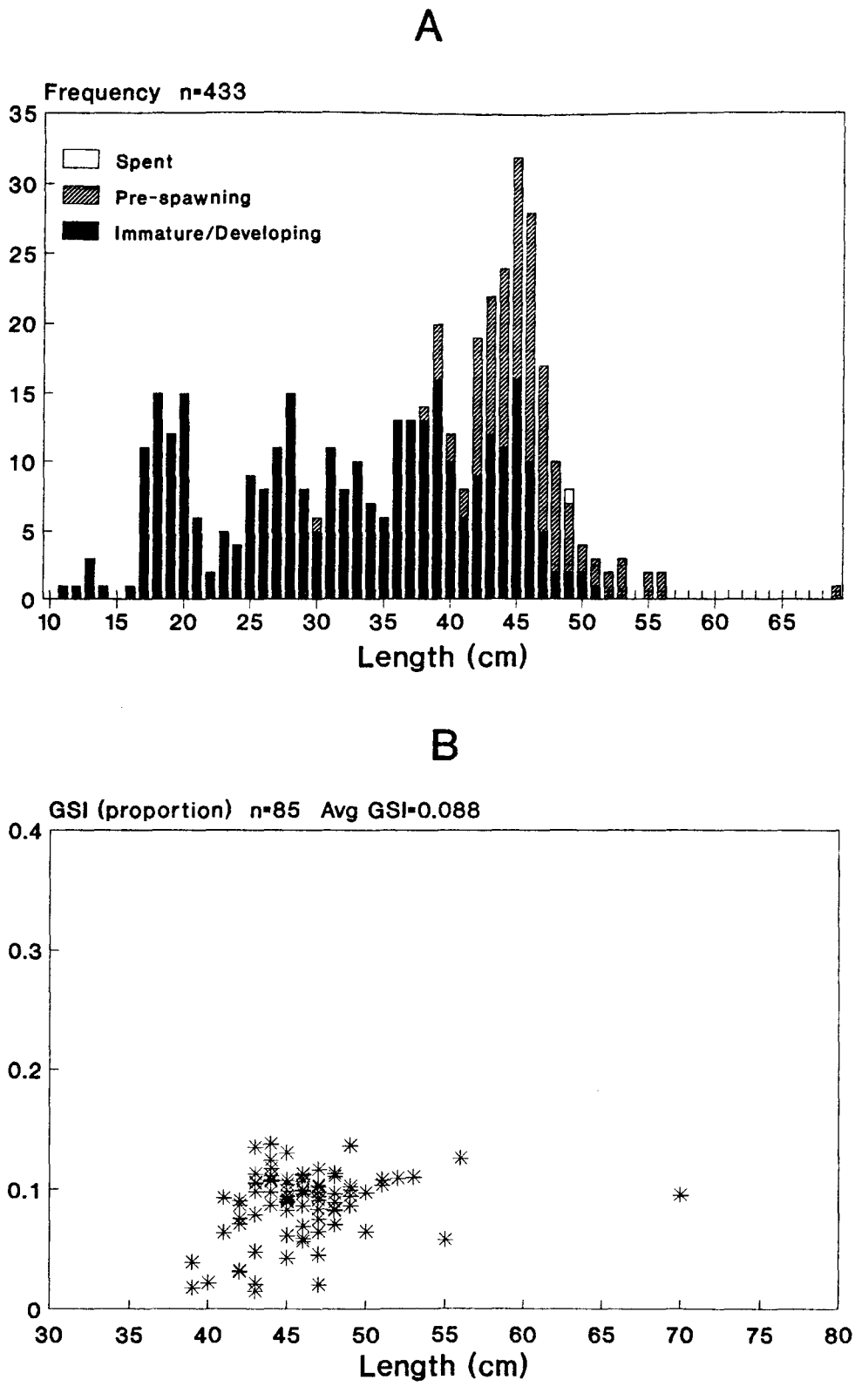

Figure 7. A) Female pollock maturity-length composition and B) gonado-somatic index (GSI) vs. length scatterplot for mature (pre-spawning) females from the western Bering Sea shelf. Relative proportion by size for maturity-length composition reflects number of maturity samples collected and is not indicative of actual size composition of the population. (Note: in (A), one 69 cm pollock should be 70 cm.)

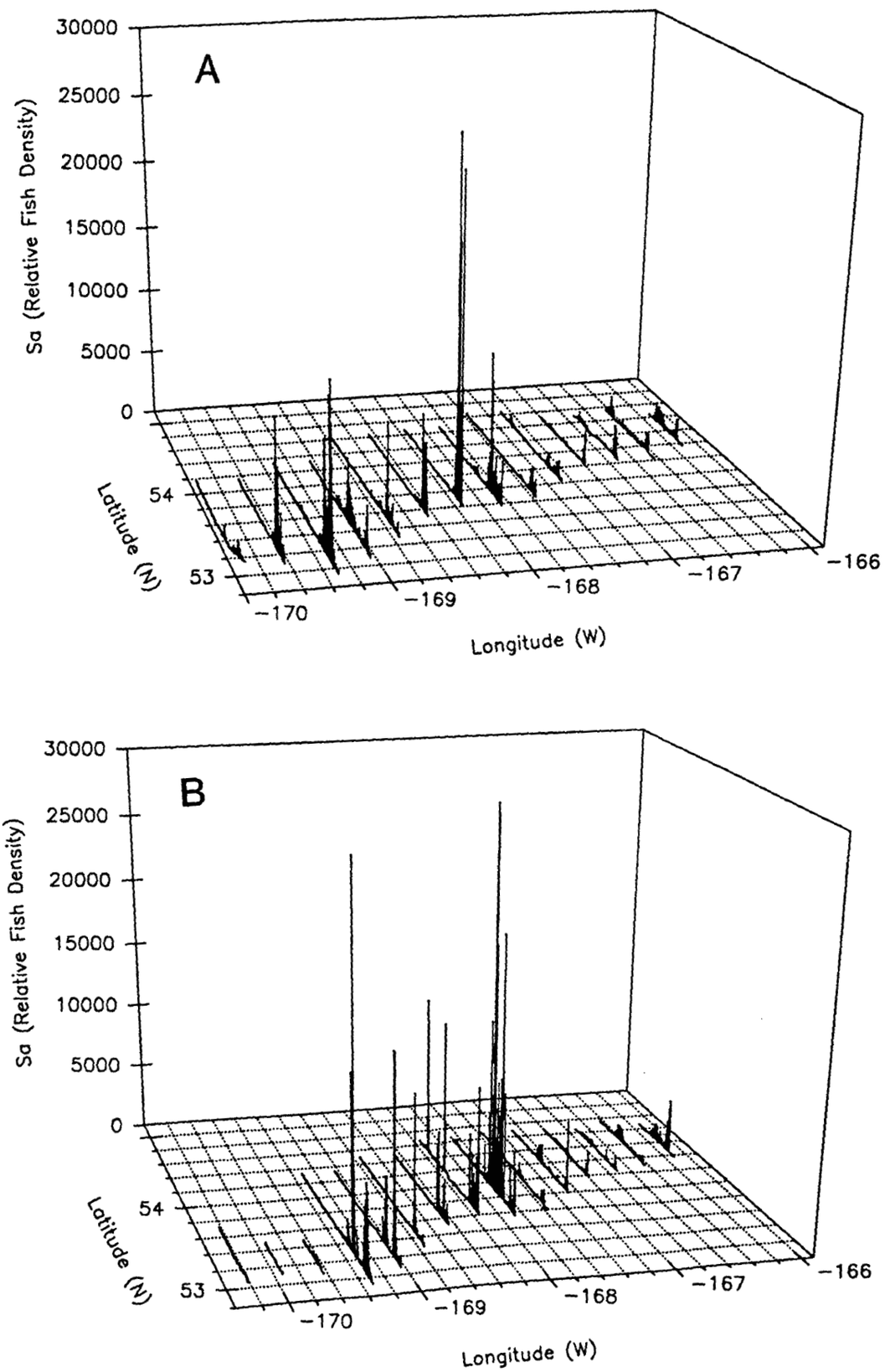

Figure 8. Relative pollock density along tracklines from the winter 1993 EIMWT survey of the southeast Aleutian basin near Bogoslof Island (A) pass 1 and (B) pass 2 (three out of range values not shown.)

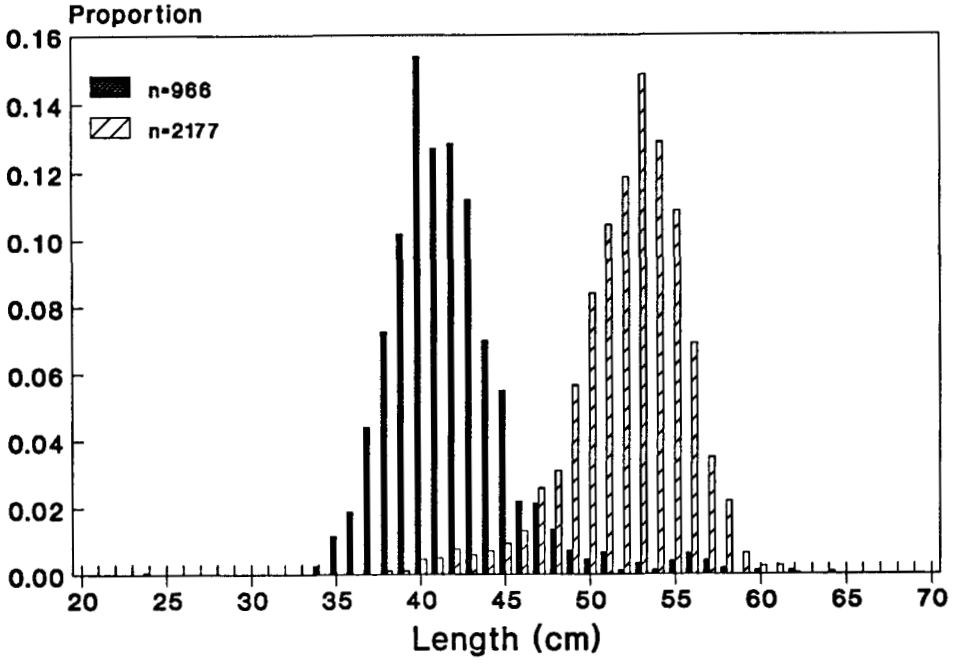

Figure 9. Preliminary pollock size composition from the southeast Aleutian basin near Bogoslof Island. Length mode on right (striped), midwater trawl samples from bottom depths >600 m (hauls 19-25 & 43); left length mode (solid), midwater trawl samples from bottom depths <600 m (hauls 14,16,18).

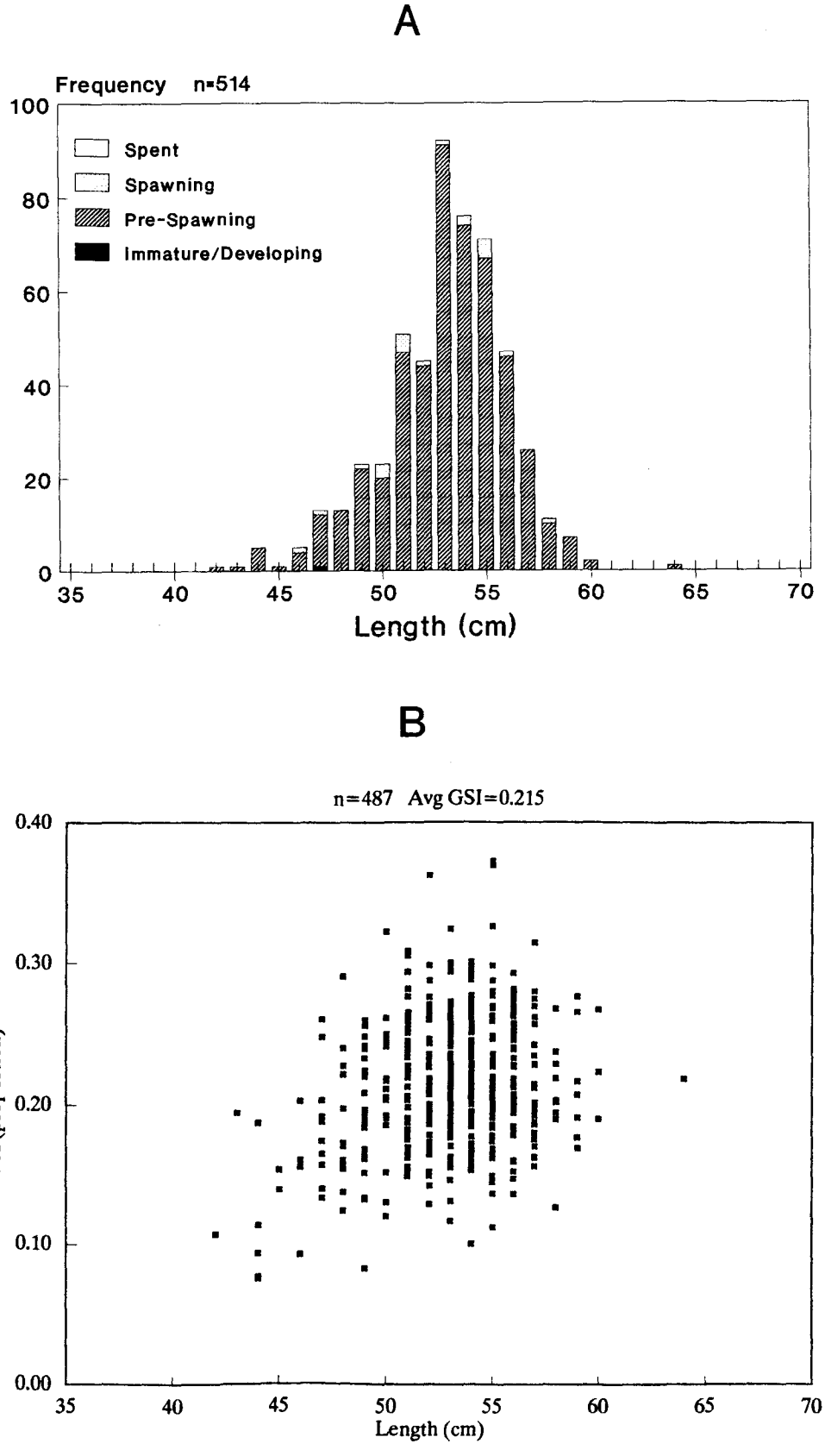

Figure 10. A) Female pollock maturity-length composition and B) gonado-somatic index (GSI) vs. length scatterplot for prespawning females from the southeast Aleutian Basin near Bogoslof Island (hauls 19-25). Relative proportion by size reflects the number of maturity samples collected and is not indicative of actual size composition of the population.

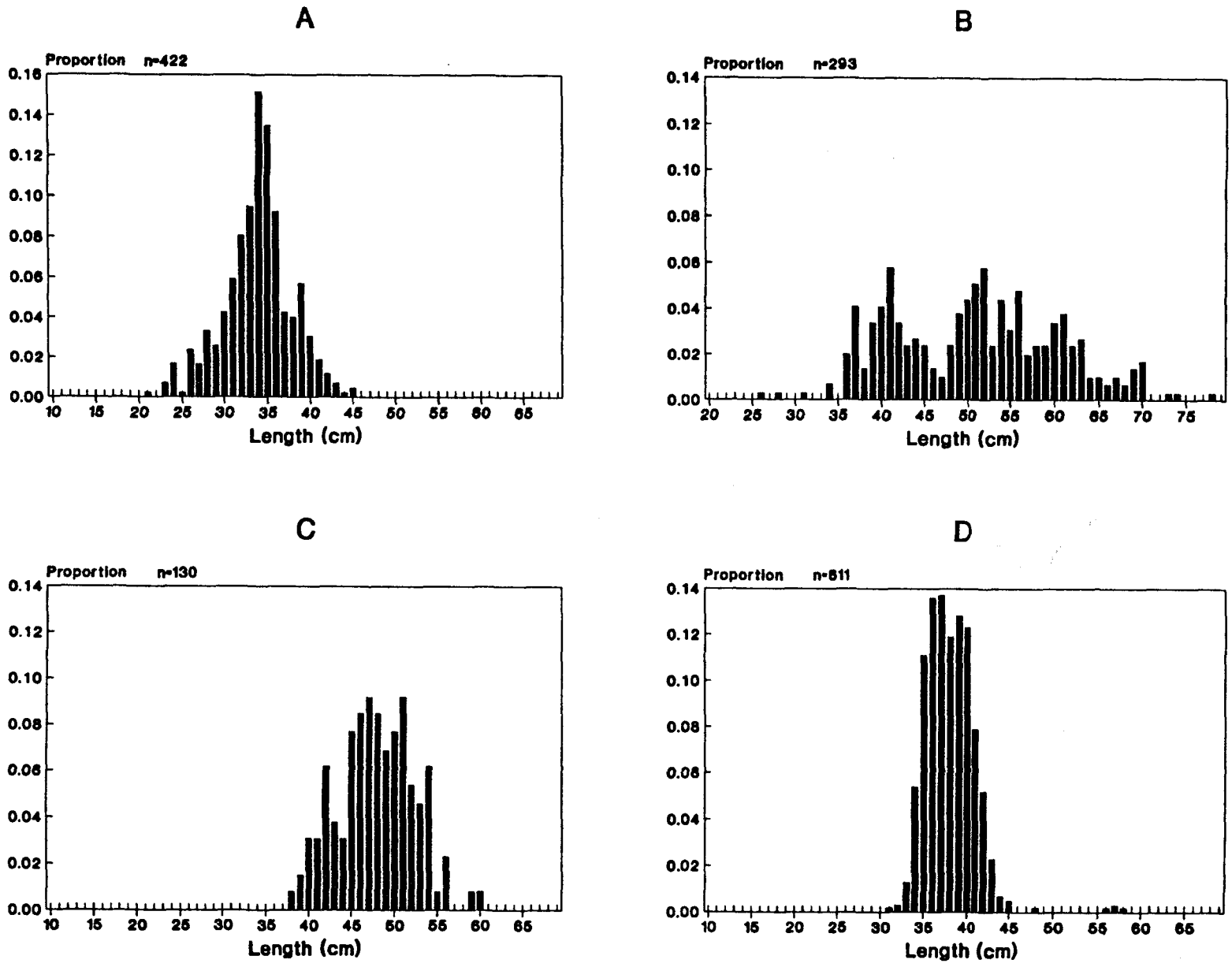

Figure 11. Preliminary pollock size compositions from A) a midwater trawl sample (haul 28), and B) a demersal trawl sample (haul 29) southwest of St. Paul; midwater trawl samples from C) a pre-spawning aggregation in Pribilof Canyon (haul 33) and D) the most common size class encountered southeast of the Pribilofs on the EBS shelf (haul 35). (in (B), a 12 cm pollock was omitted.)

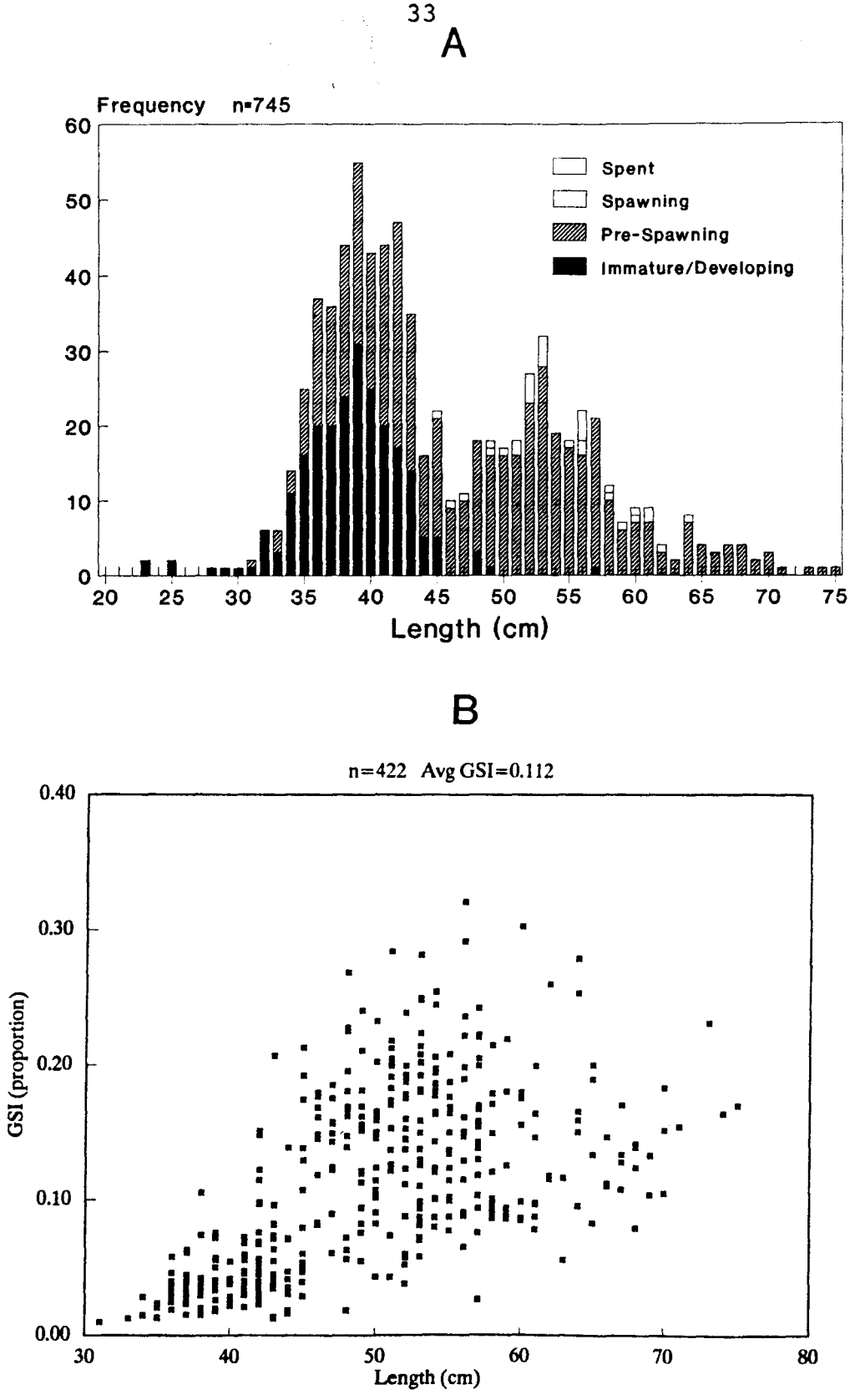

Figure 12. A) Female pollock maturity-length composition and B) gonado-somatic index (GSI) vs. length scatterplots for pre-spawning females from the eastern Bering Sea shelf and slope. Relative proportion by size reflects the number of maturity samples collected and is not indicative of actual size composition of the population.